Objectivity: A Kantian Perspective

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The subject of this paper is objectivity from Kant's point of view: or better, my own perspective on Kant's perspective on objectivity. More precisely, I want to draw attention to some aspects of the latter, which I believe are too narrow and must be widened before we can benefit from a Kantian approach today.

The great and lasting novelty of Kant's approach lies, to my mind, in the notion that objects which are the referents of epistemic discourse, be they things and their attributes, or objective situations and objective developments, are not *given* but *constituted*, articulated in the stream of becoming by our own regulated activity of composition or 'synthesis'. In other words: objectivity is an *achievement*, is not a *gift*. Scientific realists might feel inclined to question the originality of this view, inasmuch as they—who can trace their doctrine all the way back to Parmenides or at least Democritus—also believe that objectivity is an achievement, which can only be attained by painstakingly fighting off the idols that muddle our native subjectivities. But there are big differences between the scientific realist's ready-made world of perfectly definite objects waiting for the scales to fall from our eyes so that we get to see things in their own light as they are in themselves, and Kant's conception of the world as an *Idee* or program for the local, partial, approximate construction of objects by ever imperfect but endlessly perfectible modeling according to *our* lights. Not the least important and surely the most attractive of these differences is that, whereas the scientific realists must relegate the achievement of objectivity to the end of the road, the Kantian scientists can take pride in their daily achievements of contextual, improvable, incomplete, but reasonably working and passably stable objective truths. Thus, for example, from a Kantian perspective, a report that the traffic light in such and such a street corner in Bloomsbury is out of order and does not switch at regular intervals from red to green and back again to red, is a piece of *objective* knowledge although it involves reference to subjective perceptions of colour and does not describe the physical system in question in terms of string theory or whichever will be the final physical theory of everything.

Modern philosophy, from Descartes onwards, and especially in the shape it took in the British Isles, assumes what we may call the

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methodological primacy of subjective *Erlebnisse* (the standard English word for *Erlebnis* is, of course, 'experience'; but one must be careful with this word when speaking about Kant, for it is also employed to translate Kant's term *Erfahrung*, which designates what is for him the very locus of objectivity). On the said assumption, the philosopher accepts the flow of feelings, sensations and fantasies as unquestionably certain, just as it comes and goes, and seeks to build a bridge from it to the so-called 'external world' of objective things and facts. Kant sets out from this same starting point—otherwise he could not have been a partner to the philosophical conversation of his time—but he turned the said quest for objectivity on its head. Instead of looking for a handle in the sensuous manifold, by seizing which one could jump out of the 'stream of consciousness', he contends that no such stream is possible, at any rate not one attended by consciousness, unless it consists in the steady and progressive construction of an objective system of nature.

Kant argues for this in two ways which differ so much in surface structure and apparent intention that their kinship usually eludes the reader. One argument is presented on pp. 99–110 of the first edition of the *Critique of pure reason*,[1] and forms the core of Section 2 of 'On the deduction of the pure concepts of the understanding'. This passage was deleted, like several others, in the second edition,[2] not—says Kant (on p. XLII thereof)—because he no longer agreed with them, but to make room for the addition of other passages. One of these is labelled 'Refutation of idealism', and offers a less profound and ambitious argument to substantially the same effect (B 274-279). The gist of this argument is the following. To be compatible with *self*-awareness, without which no *mere* awareness is possible, the flight of *Erlebnisse* in time must be referred to *steady* and therefore *spatial* objects. Readers who reach this point of the second edition will be acquainted with the table of the categories, the 'deduction' of their objective validity, the 'schematism' by which they operate the constitution of objects and the principles that govern this operation; so Kant can take for granted everything that, according to him, is implied in the reference of *Erlebnisse* to objects. The argument in the first edition precedes almost all these sections and therefore must go deeper into the question of constitution.

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[1] Kant (1781). References to this edition will be designated by KrV A, followed by the page number. All translations from this work are by the author (RT).

[2] Kant (1787). References to this edition will be designated by KrV B, followed by the page number. All translations from this work are by the author (RT).

Roughly stated, the argument in KrV A proceeds as follows: absolutely nothing is *simple* in the stream of *Erlebnisse*;[3] therefore, fragments of the stream can be sensed only if they are run through and held together in 'the synthesis of apprehension'. To bring this about in the midst of the stream's incessant flow, apprehension must be assisted by recollection. Thus, for a melody to be heard, every segment of it must somehow be remembered at the time the last note comes forth. Yet, as Kant pointedly remarks, if there is no awareness that what is being noticed now is one and the same thing that was noticed a moment ago, the entire reproduction in the sequence of *Erlebnisse* will be in vain. The requisite identification is achieved by 'the synthesis of recognition in a concept'. 'Every cognition—says Kant—requires a concept, no matter how imperfect or unclear it might be. By nature, a concept is always something (. . .) that serves as a rule.' Indeed a concept can only work for the recognition, reproduction and apprehension of *Erlebnisse* insofar as it grasps the regular patterns of the *Erlebnis* manifold and thereby represents 'the synthetic unity in the awareness thereof'.[4] On the other hand, recognition, that is, awareness of the identity of that which is being successively grasped, cannot take effect without awareness of the identity of the very act of grasping. This form of awareness, that is, *self-awareness*, is called by Kant *apperception* (after Leibniz). It is the key to Kant's conception of objectivity. Let me quote just one convoluted but pivotal passage of the first *Critique*:

> The original and necessary awareness of the identity of oneself is at the same time awareness of an equally necessary unity of the

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[3] KrV A 784/B 812, A 772/B 800. See also vol. 28, pp. 281f. and vol. 8, p. 208 of *Kant's gesammelte Schriften*, (Berlin: De Gruyter). Henceforth I shall refer to this edition as Ak, followed by volume and page number, with a colon separating both numbers. Translations from this work are by the author (RT).

[4] The last five lines of the main text are in part a translation, in part a paraphrase of the following passage: 'Alles Erkenntniß erfordert einen Begriff, dieser mag nun so unvollkommen oder so dunkel sein, wie er wolle; dieser aber ist seiner Form nach jederzeit etwas Allgemeines, und was zur Regel dient. So dient der Begriff vom Körper nach der Einheit des Mannigfaltigen, welches durch ihn gedacht wird, unserer Erkenntniß äußerer Erscheinungen zur Regel. Eine Regel der Anschauungen kann er aber nur dadurch sein, daß er bei gegebenen Erscheinungen die nothwendige Reproduction des Mannigfaltigen derselben, mithin die synthetische Einheit in ihrem Bewußtsein vorstellt' (KrV A 106).

> composition of all appearances according to concepts, that is, to rules that not only make them reproducible with necessity, but also, in so doing, *determine an object for their intuition*, that is, the concept of something wherein they are necessarily interconnected. For the mind could never think of its own identity in the manifold of its ideas (*Vorstellungen*) (. . .) if it did not have before its eyes the identity of its act, which subordinates all synthesis of apprehension (. . .) to a transcendental unity and makes its regular interconnection a priori possible.[5]

Right after this passage, Kant declares that henceforth we shall be able to better characterize the abstract notion of an *object* in general, that is, what he calls 'the transcendental object'.[6] This turns out to be neither more nor less than the intellectual support that holds the identity of the mind's act before the mind's 'eye'.

> The pure concept of this transcendental object (which in effect is always in all our cognitions the same unspecified X) is what can generally procure a relation to an object, that is, objective reality, to all our empirical concepts. This concept cannot contain any definite intuition, and therefore concerns exclusively that unity which must be found in a manifold of cognition insofar as it stands in relation to an object. This relation, however, is nothing else than the necessary unity of consciousness, and with it also of the synthesis of the manifold through the

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[5] 'Also ist das ursprüngliche und nothwendige Bewußtsein der Identität seiner selbst zugleich ein Bewußtsein einer eben so nothwendigen Einheit der Synthesis aller Erscheinungen nach Begriffen, d.i. nach Regeln, die sie nicht allein nothwendig reproducibel machen, sondern dadurch auch ihrer Anschauung einen Gegenstand bestimmen, d.i. den Begriff von Etwas, darin sie nothwendig zusammenhängen: denn das Gemüth könnte sich unmöglich die Identität seiner selbst in der Mannigfaltigkeit seiner Vorstellungen und zwar a priori denken, wenn es nicht die Identität seiner Handlung vor Augen hätte, welche alle Synthesis der Apprehension (die empirisch ist) einer transscendentalen Einheit unterwirft und ihren Zusammenhang nach Regeln a priori zuerst möglich macht' (KrV A 108. I include here all the words I have represented by ellipsis in the translation).

[6] Speaking of 'the transcendental object of sense intuition' (*das transscendentale Obiect der sinnlichen Anschauung*), Kant says in Reflection 5554: 'This is no real object or given thing, but a concept in relation to which appearances have unity' (*Dieses ist aber kein reales obiect oder gegeben Ding, sondern ein Begrif, auf den in Beziehung Erscheinungen Einheit haben.*—Ak 18: 230).

> common function of the mind that is capable of combining it in one idea.[7]

This radically innovative and for many people shocking conception of objectivity is both clarified and strengthened by Kant's words in Reflection 5643:

> We know an object only as something in general, for which the given intuitions are merely predicates. How they can be the predicates of something else cannot be known by comparing them with it, but only through the manner how consciousness of the multiple in general can be regarded as necessarily combined in one consciousness. The multiple is unified in the idea of an object. All intuitions are merely ideas; **the object to which they are referred lies in the understanding**.[8]

In his letter to Marcus Herz, on 21 February 1772, Kant told his friend he had asked himself for the ground of the reference of our ideas to an object.[9] The argument I have just sketched provides an answer to this question and paves the way for Kant's purported proof that the rules governing the constitution of objects through the threefold synthesis of *Erlebnisse* ultimately—or rather, primarily—are none other than the concepts listed in the 'table of the categories' he had elicited, not without some sleight of hand, from the various classifications of judgments he found in contemporary German textbooks of logic.[10] I cannot go into details but I must emphasize this: *all* that Kant's laborious Transcendental Deduction of the Categories can claim to prove is that *some such* non-empirical concepts are required to spell out subjective appearances in order to read them as objective experience (*Erfahrung*). However, it does not follow from the transcendental deduction that those concepts are contained in a given, finite list, let alone that they cannot increase or vary. Surely Kant, prompted by his religious beliefs, would have sternly denied that they do. But Kant forthrightly acknowledged that 'this peculiarity of our understanding, that it can produce *a priori* unity of apperception solely by means of categories, and precisely by such and so many' admits no further explanation.[11] The great British Kant scholar, H.J. Paton, who was born under Queen Victoria, barely touched on this text in a footnote and left it out of his index of quoted passages.[12] Yet for us today it would be very hard to countenance a Kantian perspective on anything if Kant himself had not openly conceded the groundlessness of Reason.

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[7] 'Der reine Begriff von diesem transscendentalen Gegenstande (der wirklich bei allen unsern Erkenntnissen immer einerlei = *X* ist) ist das, was allen unsern empirischen Begriffen überhaupt Beziehung auf einen Gegenstand, d.i. objective Realität, verschaffen kann. Dieser Begriff kann nun gar keine bestimmte Anschauung enthalten und wird also nichts anders als diejenige Einheit betreffen, die in einem Mannigfaltigen der Erkenntniß angetroffen werden muß, so fern es in Beziehung auf einen Gegenstand steht. Diese Beziehung aber ist nichts anders, als die nothwendige Einheit des Bewußtseins, mithin auch der Synthesis des Mannigfaltigen durch gemeinschaftliche Function des Gemüths, es in einer Vorstellung zu verbinden' (KrV, A 109).

[8] 'Wir kennen ein obiect nur als ein Etwas überhaupt, dazu die gegebene Anschauungen nur Prädicate sind. Wie diese nun von einem Dritten die praedicate seyn können, kan durch ihre Vergleichung nicht erkannt werden, sondern durch die Art, wie in einem Bewustseyn das Bewustseyn des Manigfaltigen überhaupt als nothwendig verbunden angesehen werden könne. In der Vorstellung eines obiects ist das Manigfaltige vereinigt. Alle Anschauungen sind nur Vorstellungen; das Obiect, darauf sie bezogen werden, liegt im Verstande' (Ak 18: 283). Cf. also this passage from Reflection 5642: 'Wenn wir zur Warheit noch etwas mehr erfodern als den durchgängigen zusammenhang der Anschauungen nach Gesetzen des Verstandes, worin wolten wir sie denn setzen, wenn dieses nicht Zugleich die Vorstellung eines bestimmten obiects wäre. *Soll es ausser dem noch in Übereinstimung mit etwas anderm, was nicht in unsern Vorstellungen liegt, seyn, wie wollen wir es damit vergleichen*. Alle obiecte werden nur durch die Vorstellungen in mir bestimt; was sie übrigens an sich seyn mögen, ist mir unbekannt' (Ak 18: 281; my emphasis).

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[9] 'Ich frug mich nemlich selbst: aus welchem Grunde beruhet die Beziehung desienigen, was man in uns Vorstellung nennt, auf den Gegenstand?'(Ak 10: 130).

[10] The match between Kant's table of judgments (KrV, A 70/B 95) and his table of the categories (KrV, A 80/B 106) has often been questioned because it requires the addition of singular and indefinite judgments to the then familiar classifications. But when I speak of Kant's sleight of hand I am thinking mainly of the implausible link he establishes between quantification in the natural sciences and the traditional classification of subject-predicate statements into affirmative and universal (A), negative and universal (E), affirmative and particular (I), and negative and particular (O). I, for one, have never been able to see more than a pun on the words 'quantity' and 'quality' in the alleged correspondences between universal, particular and—if you wish— singular judgments and the principle of the axioms of intuition and between affirmative, negative and—if you wish—indefinite judgments and the principle of the anticipations of perception.

[11] See KrV B 145f. Kant's Reason has no further reason, but, like the proverbial rose of Angelus Silesius, 'sie blühet weil sie blühet'.

[12] Paton (1936), vol. 1, p. 536, fn. 1.

By admitting that there is *no reason why* the constitution of objects by the human understanding must follow precisely the patterns listed and described by him, Kant opens a wide door to intellectual pluralism, which indeed has thrived in his wake. However, his conception of the understanding as a closed system of rules with full authority over every cognitive judgment makes it virtually impossible to think that there is more than one form of understanding, expressed in a single fixed 'categorial framework' or 'conceptual scheme'; for thoughts belonging to one such closed intellectual system could not be understood or even recognized as *thoughts* in the context of a different closed system. Now, the very idea of intellectual closure is unpalatable to us, especially if it goes with the idea that the complete set of primary concepts of the understanding is equinumerous with that of the signs of the Zodiac and that of the apostles of Jesus. Moreover, the explosive growth of knowledge in the last two centuries has persuaded us that at least one of Kant's principles of pure understanding is untenable, namely, the Third Analogy of Experience, which proclaims the necessity of instantaneous action at a distance; that he confuses efficient causality with determinism, although the latter is time-symmetric and the former is not; and that the concept of probability, which —in Ian Hacking's phrase—*emerged* in the seventeenth century in the full light of European intellectual history— nevertheless should have a place in a list of primary concepts, for, although one might perhaps think of characterizing probability as quantified possibility, the Kantian definition of real possibility as agreement with the formal conditions of experience leaves no room for quantification.

Such facts have strengthened the impression not infrequent in the twentieth century that Kant's *Critique of pure reason* contains very little that could be of philosophical use to us. As with all major thinkers of the past, this is probably true of what Kant offered as his *doctrine*, but we cannot, in all fairness, say the same of the insights that he so often expresses in passing or which can be read in his books between lines. I shall now quote a short sentence of the 1787 edition of the *Critique* which, when read together with two other passages he wrote in the 1790s, throws an unfamiliar light on the doctrine of the categories and offers a way of bypassing the inconveniences I have mentioned. Kant writes: 'Among all ideas *combination* is the only one that is not given through objects, but can only be performed by the subject itself, because it is an act of its self-activity'.[13] A similar statement appears in the manuscript about advancements in metaphysics, written in 1791: 'All the ideas (*Vorstellungen*) that constitute an experience (*Erfahrung*) can be counted as belonging to sensibility, with only one exception, namely, the idea of the composite, as such. For composition cannot fall under the senses but we must make it ourselves; thus, it does not belong to the receptivity of the senses, but to the spontaneity of the understanding, as an a priori concept'.[14] If the notion of combination or composition *as such* is, according to Kant, *the only one* that pertains to the understanding alone and 'is not given by objects', then surely all other notions are obtained through the objects constructed—*by combination*—from the stream of *Erlebnisse*. Now, unless I am quite wrong, *all other notions* include the twelve categories. Indeed, Kant himself did not draw this conclusion from his very drastic assertion. Instead, on 11 December 1797, he explained to Tieftrunk that

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[13] 'Unter allen Vorstellungen die *Verbindung* [ist] die einzige, die nicht durch Objecte gegeben, sondern nur vom Subjecte selbst verrichtet werden kann, weil sie ein Actus seiner Selbstthätigkeit ist' (KrV, B 130).

> The concept of the composite in general is not a particular category, but is contained in all categories [. . .]. For the composite cannot be intuited as such, but the concept or consciousness of composition (a function which, as synthetic unity of apperception lies at the root of every category) must precede in order that the manifold given to intuition be combined in one consciousness, that is, in order to grasp the object as something composite.[15]

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[14] 'Alle Vorstellungen, die eine Erfahrung ausmachen, können zur Sinnlichkeit gezählt werden, eine einzige ausgenommen, d.i. die des Zusammengesetzten, als eines solchen. Da die Zusammensetzung nicht in die Sinne fallen kann, sondern wir sie selbst machen müssen: so gehört sie nicht zur Receptivität der Sinnlichkeit, sondern zur Spontaneität des Verstandes, als Begriff a priori' (Ak 20: 275f).

[15] 'Der Begrif des Zusammengesetzten überhaupt ist keine besondere Categorie, sondern in allen Categorien (als synthetische Einheit der Apperception) enthalten. Das Zusammengesetzte nämlich kann, als ein solches, nicht angeschauet werden; sondern der Begrif oder das Bewußtsein des Zusammensetzens (einer Function die allen Categorien als synthetischer Einheit der Apperception zum Grunde liegt) muß vorhergehen, um das mannigfaltige der Anschauung gegebene sich in einem Bewußtsein verbunden, d.i. das Object sich als etwas Zusammengesetztes zu denken, welches durch den Schematism der Urtheilskraft geschieht indem das Zusammensetzen mit Bewußtsein zum innern Sinn, der Zeitvorstellung gemäs einerseits, zugleich aber auch auf das Mannigfaltige in der Anschauung gegebene Andererseits bezogen wird' (Ak 12: 222f).

This might suggest that Kant regarded the twelve categories as *modes* or *specifications* of the concept of the composite in general. But then, by the same token, *all other concepts*, no matter how humble, must also be regarded as such. After all, in strict Kantian orthodoxy one ought to describe them as specifications of the categories. In the manuscript about the real advancements of metaphysics, Kant says: ‘There are therefore in the understanding as many concepts a priori under which the objects given to the senses must stand, as there are kinds of composition (synthesis) with awareness, that is, as there are kinds of synthetic unity of apperception of the manifold given in intuition’.[16] If we were bent on making sense of the doctrine of categories, as is presented, say, in §10 of the *Critique*, we would probably have to say that specification by the twelve categories is inherent in or intrinsic to the very notion of composition, and—like Klaus Reich or Béatrice Longuenesse—we would contrive a clever argument to prove that this is so.[17] But if, on the contrary, we perceive the 4 × 3 table of the categories as a millstone around Kant’s neck and wish to free him from its burden, we should seize on the opportunity that he himself gave us when he said that the concept of composition is ‘in the end, *the only* fundamental concept a priori which, in our understanding, originally underlies all concepts of objects of the senses’.[18] All specification of this concept—in effect the entire task of articulating the stream of *Erlebnisse* to integrate it in the synthetic unity of apperception—is then entrusted to the creative interplay between the sensibility and the understanding studied by Kant in the *Kritik der Urteilskraft* and to which he refers in the 1797 letter to Tieftrunk as 'the schematism of the power of judgment'.

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[16] ‘Es werden also so viel Begriffe a priori im Verstande liegen, worunter die Gegenstände, die den Sinnen gegeben werden, stehen müssen, als es Arten der Zusammensetzung (Synthesis) mit Bewußtseyn, d.i. als es Arten der synthetischen Einheit der Apperception des in der Anschauung gegebenen Mannigfaltigen giebt’ (Ak 20: 271). Kant obviously believed that the said ‘kinds of composition’ were none other than his twelve categories.

[17] Reich (1932) caused a great impression on me when I read it in the 1960s, but it did not last long. On the other hand, Longuenesse (1998) is perhaps the most illuminating and stimulating book about Kant that I have read, especially in its Part Three. Nevertheless, doubts remain as to whether there is more than homonymy between ordinary and scientific concepts of quantity and the ‘quantity’ of categorical judgments, or that the concept of physical interaction has anything to do with the truth-functional operator of exclusive disjunction. I do, however, agree completely with her description of the structure of Kant’s argument in the Transcendental Analytic and her proposals for re-reading the Transcendental Aesthetic, and I believe that nobody who has studied her book can maintain that Kant’s doctrine of the categories was implausible or unworthy of a great philosopher.

[18] Ak 20: 271; my emphasis.

According to Kant, the power of judgment operates in two directions: working from the top down, it brings particular *Erlebnisse* under available concepts through which they are grasped as presentations of objects; working from the bottom up, it finds and—if needs be—it creates general concepts suitable for articulating the particulars it discerns in the stream of *Erlebnisse*. This form of operation from the bottom up is evidently indispensable if combination or composition is the only concept that is originally available, whether or not it comes modulated by twelve categories. Kant calls it 'reflection' and ascribes it to *die reflectierende Urteilskraft*, because he remains enthralled by the traditional empiricist—in effect, Aristotelian—view of concept formation. According to this view, a general concept is obtained by *comparison* of particulars, *reflection* about their similarities, and *abstraction* of their common features. This description fits the job of the naturalist who explores a new territory, classifying minerals, or plants, or insects. But concept formation in mathematical physics does not proceed in this way and Kant certainly knew it. Indeed he was perhaps the first philosopher to fully realize that the Aristotelian scheme is insufficient for modern science. But he apparently believed that, just like—in his opinion—Aristotle himself had in one fell swoop reached the end of the road in logic, so had Newton established the principles and basic concepts of physics once and for all. On this assumption it was not unreasonable to come up with 'metaphysical principles of natural science' which reflect the Newtonian achievement but which also match well enough the principles and basic concepts of the human understanding that Kant had gleaned from eigthteenth-century handbooks of ontology. Two centuries later, in the course of which several so-called scientific revolutions have not only occurred but have been discussed *ad nauseam*, this kind of approach is no longer viable. No matter how strong our desire for secure knowledge and stable truths, we must yield to the evidence that science's hunger for new concepts is insatiable and will not be quenched by any closed system of reason. At least in physics, we have seen cohort after cohort of increasingly complex mathematical structures emerge in the light of day, not always in full armour, claiming the right to represent vast families of phenomena within some acceptable margin of imprecision. Concepts of this kind are not meant merely to classify given objects in a received or unprecedented taxonomy, but rather to provide the intellectual setting or, if you wish, the scaffolding for objects to be articulated and displayed. Such concepts cannot be fished out of the stream of impressions, as pre-Kantian empiricists proposed, and this is probably the reason why science-conscious post-Kantian empiricism had to dress up in a 'logical' garb to enjoy a short revival in the twentieth century. Einstein, who had first-hand knowledge of the formation of physico-mathematical concepts, forcefully characterized them as 'freie Erfindungen des menschlichen Geistes', unconstrained inventions of the human mind.[19] I would not presume to say this better than Einstein did. But I shall now venture a tentative proposal linking the exercise of free invention in Einstein's sense with the imaginative interplay between the sensibility and the understanding that Kant discusses in the Schematismus chapter and again in his *Kritik der Urteilskraft*.

To explain my proposal I must lift a restriction I have respected up to this point. Except for a few allusions to the temporal flow of *Erlebnisse* and a brief hint to spatiality as a condition of steadiness, I have intentionally avoided all reference to Kant's notorious doctrine of time and space as the 'forms' of our 'internal' and 'external' sense. I am persuaded that this doctrine was the key that opened the gates of the garden of critical philosophy; but I can also see that for someone who is already inside it, Kant's presentation of this doctrine in the Transcendental Aesthetic is still too close to the pre-critical teaching of the dissertation of 1770 and does not fit the conception of the human understanding presented in the Transcendental Analytic. My point is not merely that, after Lobachevsky and Riemann, Euclidean geometry can no longer be regarded as a condition of the possibility of our experience of physical objects; but rather that Euclidean geometry, in its full richness and complexity, cannot be attributed to a pure intuition which, in Kant's words, is blind (unless it is set to work by and for the understanding). Kant himself clearly hinted that the Transcendental Aesthetic needs revision. He did so in §26 of the 1787 *Critique*, especially in the long footnote to B 160, where he distinguishes between 'the form of intuition' and 'formal intuition', and also in §38 of *Prolegomena*, where a well-known theorem of geometry is described as a law of nature posited by the understanding.[20] However, the section concerning the Axioms of Intuition (A 162-166/B 202-207)—which deals explicitly with the emergence of geometry through the interplay of intellect and sensibility in 'the successive synthesis of productive imagination' (A 163/B 204)—does not actually elucidate the formation of geometrical concepts and axioms, but simply takes it for granted. Indeed, by associating—no matter how vaguely—the 'axioms of intuition' with the categories of quantity, Kant remains beholden to the medieval conception of mathematics as the science of quantity and blissfully unaware of the geometrical significance of non-quantitative properties and relations. Of course, philosophers, though they are often endowed with above average hindsight, are not required to have any foresight at all; and it would be terribly unfair to reproach Kant for not having anticipated the tropical growth of topological, algebraic and order structures that fill the landscape of modern mathematics.

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[19] Einstein, 'Zur Methodik der theoretischen Physik' (*ca*. 1930), in Einstein (1979), p. 115.

[20] Kant, Ak 4: 320–322. As Longuenesse (1998), p. 213, tersely remarks: 'The goal of the Transcendental Deduction of the Categories

My proposal is to secure maximal freedom for Kant's *productive imagination* or *reflective judgment* by minimizing the limitations imposed on it from either end of its playground, namely, *first*, by the pure forms of sensibility and, *second*, by the pure concepts of the understanding. On the first point, Béatrice Longuenesse had this to say: 'Kant's transcendental account of the pure intuition of space provides no reason to assert that space is necessarily Euclidean, so that Kant needlessly limits the scope of his transcendental Aesthetic and Analytic, when he claims that the representation of space they ground is that of Euclidean geometry'.[21] Indeed, Kant himself acknowledged that 'space is something too uniform and too indeterminate with respect to all particular properties' to comprise a store of geometrical theorems.[22] In a more assertive mood, and following a suggestion of Henri Poincaré,[23] I dare to add that the intuitive 'form' illustrated in every *Erlebnis* merely adumbrates the mathematical notion of a—should we say four-dimensional?—coordinate patch. On the second point, concerning the other end of

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is "fully attained" only when it leads to a rereading of the Transcendental Aesthetic'.

[21] Longuenesse (1998), p. 287.

[22] *Prolegomena*, §38 (Ak 4:321).

[23] 'Je conclurai que nous avons tous en nous l'intuition du continu d'un nombre quelconque de dimensions, parce que nous avons la faculté de construire un continu physique et mathématique; que cette faculté préexiste en nous à toute expérience parce que sans elle, l'expérience proprement dite serait impossible et se réduirait à des sensations brutes, impropres à toute organisations, que cette intuition n'est que la conscience que nous avons de cette faculté'. Poincaré (1912); quoted from Poincaré (1913a), p. 157.

the playground of concept formation, I stand by what Kant said in the texts I quoted earlier: the notion of combination or composition *as such* is *the only one* that pertains to the understanding alone. Within these boundaries, but free from any additional a priori constraints, the power of judgment has plenty of room to improvise and articulate not just the familiar concept pairs *thing* and *attribute*, *cause* and *effect*, but all the grand conceptual structures employed by mathematical physics or yet to be created by its practitioners.

Kantians who adopt my proposal will no longer be put to shame by the growth of geometry or the turnabouts of mechanics. Thanks to it, Kant's pure reason can take pride on the open-endedness that actual human reason so glaringly displays. More significantly perhaps, we renounce the claim to completeness and invariability that Kant made on behalf of the categories and principles of the understanding. Thereby, we extend to reason itself Kant's intrepid rejection of unconditioned totalities, instead of allowing her to stand as the ultimate transcendental illusion. Open-endedness and detotalization yield two philosophical benefits. First of all, if we admit that scientific concept formation is ever in progress and there is no closed system of basic notions by which it must abide, we can in good faith dismiss the widespread and yet highly unlikely view of the history of science as a series of quantum jumps between incommensurable intellectual systems. The glass-and-steel towers of theory can always communicate with each other across the quicksands of ordinary discourse on which they repose. The second philosophical benefit I see is this: if even the formation of basic concepts remains incomplete, the very idea of a full inventory of predicates by comparison with which every single object might be exhaustively determined makes no sense at all, and the thoroughgoing determination of things asserted by modern pre-critical metaphysics is unthinkable.

Still, before we can say that my proposal is workable we would have to see it at work. How can this be done? One must show, in particular historical cases, how a new concept or structured panoply of concepts issues from those that were previously available—and ultimately perhaps from pre-conceptual intuitions—through an intellectual effort resembling that of Kant's productive imagination or reflective judgment. This is not easy, for mathematicians and theoretical physicists have not been fond of describing the often tortuous paths by which they reached their ideas. I dare say, however, that Riemann's lecture 'On the hypotheses that lie at the foundation of geometry'[24] bears witness to the reflections that took him from common and more or less intuitive notions of space and quantity to the concepts of differentiable manifold and Riemannian metric. Along similar lines, one could perhaps—reading Hermann Weyl, Élie Cartan and their successors—reconstruct the way from Riemann's ideas to the seemingly forbidding notion of a fibre bundle. Likewise, I believe that the evolution of Einstein's thinking about gravity—from the rediscovery[25] of the equivalence principle in 1907 to the final formulation of geometrodynamics in curved spacetime more than eight years later—can profitably be viewed from such a reformed Kantian perspective.

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[24] Riemann (1867). Riemann delivered this lecture in 1854.

The three examples I have mentioned concern conceptual innovations not directly linked to the nit and grit of laboratory life. They are also quite foreign to the myriad-year old everyday fight for life in which and for which our most common concepts were born. This reminds us of a limitation that Kant's philosophy shares with its predecessors. Kantian objectivity is achieved through the doings of the human understanding,[26] but the understanding is for Kant a handless actor. We ought to manage to consistently think of it as acting from a body in order to properly understand the presence of objects as *pragmata*, as the Greek founders of philosophy spontaneously called them in their mother tongue.[27]

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[25] I say 'rediscovery' because the equivalence principle is already implicit in Corollary VI to Newton's Laws of Motion, as Herbert Stein (1977) pointed out.

[26] 'Intellektuell ist, dessen Begriff ein Tun ist' (Kant, Reflection 4182, Ak 17: 447).

[27] In the discussion that followed the reading of this paper at the UCL conference, Professor Michael Friedman remarked that, as far as he could tell, the effective elucidation and solution of problems in the philosophy of science had gained little or nothing from the consideration of cognition as a form of embodied intelligent action. Replying to his comments, I proposed the book by James Woodward (2003)—and the work of his predecessors Judea Pearl and Clark Glymour *et al*.—as a harbinger of what one might expect in this field. By linking the origin and meaning of the concept of cause to the live experience of human intervention in the course of things, these authors have not only thrown much light on a famously obscure concept but have also paved the way for understanding the difference between the discrete causal chains we discern everywhere, both in ordinary and in laboratory life, and the deterministic evolution of closed physical systems governed by the differential equations of mathematical physics.

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